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The Effect of Economic Factors on Murder Rate in USA

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THE EFFECTS OF ECONOMIC FACTORS ON MURDER RATE IN USA

By

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TITLE: THE EFFECTS OF ECONOMIC FACTORS ON MURDER RATE IN USA

MAJOR PROFESSOR: Dr. Scott Gilbert

This paper examines the effects of unemployment, population, per capita income, and education on murder rate in USA. The purpose of the paper is to determine which factor or factors affect the murder rate in USA. Using Time Series, and Cross Sectional analysis, one can investigate which factor or factors influence murder rate. For Time Series, data from 50 states for the time period of 1961-2007, and for Cross Sectional analysis, 2005 was used. For both the analyses, OLS estimation method was used. In Cross Sectional, all variables turned out to be insignificant. However, in Time Series, Per Capita Income was the only variable that had a significant effect on murder rate.

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INTRODUCTION

The act of murder is distinct to humanity. While animals kill other animas outside of their own species for food, and may fight, hurt, would or very occasionally kill within species for territory, it is only within humankind that one individual — out of malice or rage, for revenge or profits— takes another individual's life by violent means. Though most religions and cultures always advocated murder to be unnatural (the very use of the words 'cold blooded' denote our desire to see it as less than human), its continued presence within our history might, if we were to be more honest, suggest the opposite.

By definition, a murder is a homicide (the killing of one individual by another) that is committed intentionally, or with malice. All legal codes classify it as a crime, where the element of motive exists and there are no mitigating circumstances, the punishment may be death or life imprisonment. Murder is assumed if a corpse shows injuries or circumstances that raise suspicion or if obvious evidence of criminal violence is found, as in death resulting from a gunshot or stab wounds, burning, and battery.

BACKGROUND

According to a statement by FBI, in 2005, murders in the United States jumped up by 4.8 percent, and overall violent crimes rose up by 2.5 in the year 2004, marking the largest annual increase in crime rate in the United States of America since the year 1991. Robberies increased nationally by 4.5 percent, and aggravated assaults increased by 1.9 percent, while the number of rapes declined by 1.9 percent, the report stated. Crime increased most notably in several categories in many mid-sized cities and in the Midwest.

Crime figures had begun to balance in the past few years and some categories of crimes had edged up slightly in 2001, but had not shown an increase of this proportion. Several experts cited the reasons to be aging population and stricter sentencing as key factors that contributed to the gradual decline in crime throughout the 1990s and into the start of the new century. But some leading criminologists differ on this, and say that those factors are changing and they are not at all surprised by the new numbers. The statistical records for all cities that have a population of 100,000 or more show that the largest increase in overall violent crimes occurred regionally in Midwest. The total number of robberies, murders, rapes and assaults increased by 5.7 percent in 2006. FBI officials, who have compiled the statistics provided by the respective law enforcement agencies noticed strong variations among cities. Even among classes of crimes within cities, there were few distinguishable patterns. Authorities opined that the migration of gangs into smaller towns and cities with fewer law enforcement authorities may have accounted for some of the violence being reported. Police in some cities reported that the crime increases reflected unusually low numbers in 2004 rather than the unusually high numbers in 2005.

LITERATURE REVIEW

In an article published in *The New York Times by* Adam Liptak titled "*Does Death Penalty Save Lives? A New Debate,*" the author expressed that there are contrasting opinions about capital punishment due to the influence of many varied studies conducted by the economists. On one hand, economists agreed depending on their econometric analyses that capital punishment does dissuade violent crimes. And on the other hand, other experts, mostly legal scholars, are against these studies that provoke capital punishment as a solution to decrease the homicide crime rate.

The article states that there are about a dozen current studies orchestrated mostly by economists that reached to a surprising result from their econometric analysis that capital punishment does deter the murder rate. Although, H. Naci Mocan, an economist at Louisiana State University, opposes capital punishment, but his studies showed a negative effect between murder rate and capital punishment. Despite the fact that Cass R. Sunstein, a law professor at the University of Chicago, has a liberal point of view, he agrees with the capital punishment as a solution to decrease the murder rate.

Although most who oppose capital punishment are legal scholars stating their conflicting opinion in law reviewed journals, two prominent law professors, Professor Sunstein and Adrian Vermeule, a law professor at Harvard, suggest in that capital punishment does deter murder. Furthermore, they state that "Those who object to capital punishment, and who do so in the name of protecting life, must come to terms with the possibility that the failure to inflict capital punishment will fail to protect life."

On the other hand, there are many experts, mostly legal scholars, who oppose the notion of the deterrent effect of capital punishment has on murder. They mentioned that these studies are based on wrong premises, insufficient data and flawed methodologies. For example, Professor Wolfers, who is an expert on death penalty studies, stated that instead of spending money on capital punishment, which cost more than $ 1 million, why not spend that amount of money on policing or crime prevention. Therefore, Professor Wolfers and Professor Donohue concluded that there is no significant relationship between homicide and capital punishment. The two professors go further by drawing a comparison between the United States and Canada stating that Canada did not implement any capital punishment since 1962, however, the murder rate for those two countries were roughly similar, which indicate that there are other factors that play a role in affecting the murder rate. For that reason, in this econometric analysis, other factors besides capital punishments have been included, for instance, unemployment rate will be included as one of my independent variables.

Most of us do agree that the act of crime is more associated with the downturn of an economy, however, shocking facts prove that violent crime, including murder, declined by 5% in 2009 for the period ending March, compared to the same period in 2010, which contradicted what most experts have anticipated. Furthermore, the number of murders has fallen by 30% in the city of LA in the first quarter of 2009 compared to the same quarter in 2010.

In *Crime and Unemployment in Scotland: An Econometric Analysis Using Regional Data* by Barry Reilly and Robert Witt, they examine the perennial question of the relationship between unemployment and crime using regional data for Scotland over the period 1974 to 1988. The paper suggests that there is a positive relationship between unemployment rate and crime and that the Scotland police' decision to dismiss the effects of unemployment is considered to be wrong. Therefore, any policies that are determined to reduce unemployment will be effective to decrease crime rate in Scotland.

However, in *Unemployment and Crime: Is There a Connection?* published in *Scandinavian Journal of Economics*, by Edmark, and Karin, a panel of Swedish counties over the years 1988-1999 is used to study the effects of unemployment on property crime rates. Crime, in this study is divided into two categories property crime and violent crime. The results showed that unemployment had a significant positive effect on some property crimes (the likes of burglary, car theft, and bike theft). However, according to Table 3 in the paper, the unemployment coefficient is insignificant for all violent crimes that includes murder as one of its contents. Furthermore, the paper states that this result is not surprising, in the sense that the theory on economics and crime suggests no direct link between unemployment and violent crime. Furthermore, education is negatively related to the number of reported crimes, while population density is negatively related to aggregate violent crime, but none of them is considered to be significant. Therefore, among the violent crimes, none is found to be significantly related to unemployment.

GOAL

The goal of this study is to identify the causes that influence the rate of murder in the USA and to what extent are those causes (independent variables) affecting the murder rate in the USA by performing regression analysis. Furthermore, economic indicators have been chosen with the assumption that they have an effect on the murder rate in order to indicate how influential those economic variables are, then to give the recommendation from an economic perspective.

Explanation of variables:

(i) Murder rate in the USA as our dependent variable (MUR).

(ii) Income per capita for each state (PERIN) as our independent variable.

(iii) The Unemployment rate for each state (UNEM) as our independent variable.

(iv) Population for each state (POP) as our independent variable.

(v) Capital punishments (CAP) as our independent variable.

(vi) Education (EDU) as our independent variable.

(vii) Year (YEAR) as our independent variable.

METHODS

In this study, two regression models were used, cross sectional and time series model, to determine an econometric/regression analysis. In addition, the sample size for cross sectional data is the number of states of the United States of America which is 50 states. However, the sample size for my time series data is the number of years starting from 1961 to 2007, which is 47 years or observations. The model of murder rate in the United States as a function of income per capita, education rate, unemployment rate, population rate, and capital punishment rate.

Cross Sectional model

In the cross- sectional model, the data is listed by states in the United States. Further, some of the independent variables in each state have been converted to a natural log format in order to standardize the units of measurement and to achieve consistency among all our variables. Specifically, simplified working variables and their corresponding data sets have been used to represent the aforementioned constructs. Listed below are these variables, their symbols, their definitions, our sources of data, and the functional forms:

- The Murder rate for each state (MUR): is dependent variable and the data is listed by state for the year 2005i. The murder rate is per 100000.
- Population rate (POP): The population for each state was in (10000), the data has been converted to a natural log in order to standardize the units. Also, it is expected to have a positive relationship between population rate and murder rate. The data is listed by state for the year 2005 ii
- Income level per capita for each state (PERIN): the natural log has been taken to achieve consistency. Further, it is expected to have negative association between income level and murder rate. Income per capita has been used for the year 2005 iii.

- Education rate (EDU): the percentage rate of people who received a B.S. degree or higher education level in each state for the year 2005iv has been used. Thus, it is expected to have a negative relationship between education rate and murder rate.
- The unemployment rate for each state (UNEM): the rate of unemployed people in each state for the year 2005v has been used. Hence, it is expected to have a positive correlation between unemployment and murder rate.
- Capital punishment rate (CAP): it is calculated here by dividing the number of executions for each state by the total executions for all states to change the numbers to rate. Further, it's expected that the more capital punishment there were, the less likely people would commit murders. Thus, it is expected to have a negative association between capital punishment and murder rate. The data are listed by state for the year 2005vi.

Below are the descriptive statistics of all the variables:

Table 1

	MUR	POP	PERINC	EDUC	CAPRATE	UNEM
Mean	5.315686	8.163904	10.30337	27.61176	2.306078	4.923529
Median	4.800000	8.336297	10.28686	26.70000	0.000000	5.000000
Maximum	35.40000	10.49555	10.76568	49.10000	37.25000	6.900000
Minimum	1.100000	6.232051	10.00431	15.90000	0.000000	2.900000
Std. Dev.	4.893971	1.046270	0.155533	6.020918	5.824820	0.948175
Skewness	4.632997	-0.056021	0.582499	0.960184	4.507986	0.093698
Kurtosis	29.25211	2.336926	3.585264	4.748845	26.66426	2.420736
Jarque-Bera	1646.943	0.960968	3.611980	14.33583	1362.731	0.787662
Probability	0.000000	0.618484	0.164312	0.000771	0.000000	0.674468
Sum	271.1000	416.3591	525.4721	1408.200	117.6100	251.1000

Sum Sq. Dev.	1197.547	54.73404	1.209523	1812.573	1696.426	44.95176
Observations	51	51	51	51	51	51

Source: E-views, data set

Given the aforementioned variables, the following functional form or the population model equation have been proposed:

- $$\mathbf{MUR} = \beta_0 + \overset{(+)}{\beta_1}(\mathbf{POP}) + \overset{(-)}{\beta_2}(\mathbf{PERIN}) + \overset{(-)}{\beta_3}(\mathbf{EDU}) + \overset{(+)}{\beta_4}(\mathbf{UNEM}) + \overset{(-)}{\beta_5}(\mathbf{CAP}) + \varepsilon$$

The variables are listed above and the βs are the coefficients. As discussed, it is expected that MUR to be positively associated with population and unemployment. On the other hand, it is expected MUR to be negatively associated with income level, education rate, and capital punishment rate. The estimation method that has been used is the Ordinary least square OLS which is the most widely used method of obtaining the estimates of the coefficients of the above model. Ordinary least square is a regression estimation technique that calculates the βs so to minimize the sum of the squared residuals. The parameter of interest is the parameter unemployment rate, and the control variables are the population rate, income level per capita, education rate, and capital punishment rate.

RESULTS

Note: The following results were analyzed using data from 50 states. Significance was determined using a one sided t-test with α = 5%, and the T critical for one sided test is 1.96. All values are rounded to the nearest hundreds. t-test statistics are listed in parentheses below their corresponding coefficients.

First, a regression including all variables has been performed. The results were as follows:

[1] MUR = -73.96 - 0.66(POP) + 6.54(PERIN) + 0.18(EDU) + 2.43(UNEM) + 0.08(CAP) + ε

(-1.1) (-1.02) (.95) (1.05) (3.58) (.76)

Adjusted R^2 = 0.23

To check whether model (1) is suffering from multicollinearity, the variance inflation factor is one of the possible methods. The VIF results were as follow for each independent variable:

Table 2

Explanatory Variables	VIF
POP	3.0
UNEM	1.12
CAP	1.15
PERIN	3.076
EDU	3.76

Source: E-views, data set

From the above chart, chart B, none of the explanatory variables had VIF higher or equal to 10 indicating that model 1 is not suffering from multicollinearity.

Furthermore, based on the results form model (1), POP, PERIN, EDU, and CAP were found to be insignificant. UNEM was the only significant of all variables. If UNEM goes up by one percent, the murder rate goes up by 2.43 percent holding other variables constant. Also, the adjusted R^2 is too low, which means 23 percent of the variation in murder rate is explained by our model. Therefore, estimated coefficients for POP, PERIN, EDU, and CAP did not reflect our prior hypothesis. I had expected POP to have a positive impact on MUR and PERIN, EDU, and CAP to have negative impact on MUR.

[2] MUR = -67.98 + 5.54(PERIN) + 0.199(EDU) + 2.25(UNEM) + 0.05(CAP) + ε

(-1.02) (.81) (1.14) (3.42) (.46)

Adjusted R^2 =0.23

Eliminating POP had little impact on the coefficients and the adjusted R^2 did not change, which means 23 percent of the variation in murder rate is explained by our model. Again, UNEM was found to be the only significant variable with the t-stat decreasing by 0.16. If UNEM increases by one percent, the murder rate will increase by 2.25 percent holding other variables constant.

[3] MUR = -10.57 - 0.57(POP) + 0.32(EDU) + 2.33(UNEM) + 0.08(CAP) + ε

(-1.7) (-0.89) (3.09) (3.47) (0.75)

Adjusted R^2 =0.23

Eliminating PERIN had little impact on the coefficients (no bias was observed). The adjusted R^2 did not change. Again, UNEM was found to be the only significant variable with the t-stat decreasing by 0.11. If UNEM goes up by one percent, the murder rate will go up by 2.33

percent holding other variables constant. The t-stat for EDU increased, but the sign differed from our expected model.

[4] MUR = -128.5 – 0.71(POP) + 12.36(PERIN) + 2.45(UNEM) + 0.08(CAP) + ε

(-3.05) (-1.12) (3.05) (3.61) (.67)

Adjusted R^2 =0.23

Eliminating EDU had little impact on all estimated coefficients except for the PERIN because it showed a large negative impact (bias was observed). The t-stat for PERIN increased, but the sign still differed from our expected model. Also, the adjusted R^2 did not change. Further, UNEM was faced to be the only significant variables. If UNEM goes up by one percent, the murder rate will go up by 2.45 percent holding other variables constant.

[5] MUR = -29.65 - 0.074(POP) + 2.879(PERIN) +. 206(EDU) + 0.09(CAP) + ε

(-.40) (-.10) (.38) (1.04) (.46)

Adjusted R^2 =0.03

Eliminating UNEM had little impact on all estimated coefficients except for PERIN because it showed a large negative impact (bias was observed). The adjusted R^2 decreased by 0.20. Also, this means that 30 percent of the variation in murder rate is explained by our model. Note that none of the t-stat was found to be significant.

6] MUR = -74.01 - 0.50(POP) + 6.47(PERIN) + 0.17(EDU) + 2.44(UNEM) + ε

(-1.1) (-.83) (.95) (.99) (3.61)

Adjusted R^2 = 0.24

Eliminating CAP had a little impact on the coefficient (no bias was observed). The adjusted R^2 increased by 0.01. Also, this means that 24 percent of the variation in murder rate is explained by our model. Note that UNEM is the only significant variable, which means if

UNEM increases by one percent murder rate will increases by 2.44 percent holding other variables constant.

CHECKING FOR HETEROSCEDASTICITY

When conducting Heteroscedasticity test by using the Breusch-Pagan-Godfrey test, it indicated the existence of Heteroscedasticity in model number 6, for the F test is significant at 5% level of significance, which means rejecting the null hypothesis that states that the independent variables do not have any effect jointly on the squared residual:

H0: $\delta 1= \delta 2=\ldots \delta 4 =0$

Table 3

F-statistic	11.61590	Prob. F(4,46)	0.0000
Obs*R-squared	25.62785	Prob. Chi-Square(4)	0.0000
Scaled explained SS	103.7434	Prob. Chi-Square(4)	0.0000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Sample: 1 51

Included observations: 51

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-873.9886	600.0313	-1.456572	0.1520
LOGPOP	-17.82717	5.474045	-3.256671	0.0021
LOGPERINC	80.26862	61.63989	1.302219	0.1993
EDUC	3.487749	1.574407	2.215277	0.0317
UNEM	22.88636	6.111045	3.745082	0.0005

R-squared	0.502507	Mean dependent var	16.49432
Adjusted R-squared	0.459247	S.D. dependent var	52.55160
S.E. of regression	38.64431	Akaike info criterion	10.23957

Sum squared resid	68695.59	Schwarz criterion	10.42896
Log likelihood	-256.1090	Hannan-Quinn criter.	10.31194
F-statistic	11.61590	Durbin-Watson stat	1.818173
Prob(F-statistic)	0.000001		

And therefore accepting the alternative hypothesis that at least one independent variable has an effect on the squared residual:

Ha: δ1≠ δ2≠ … δ4≠ 0

$$\epsilon^2 = \delta_0 + \sum_{k=1}^{4} \delta_k x_k + u$$

Below is table that shows the results for testing for Heteroscedasticity, which indicates a significant F-statistic.

Source: E-views, data set

To correct for Heteroscedasticity, the "White Heteroscedasticity-Consistent Standard Errors & Covariance" for fully robust standard errors has been used. The below table has the new standard errors and t-statistics.

Dependent Variable: MUR

Method: Least Squares

Sample: 1 51

Included observations: 51

Table 4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGPOP	-0.504911	1.020580	-0.494730	0.6231

LOGPERINC	6.470589	6.343457	1.020041	0.3130
EDUC	0.172687	0.239030	0.722450	0.4737
UNEM	2.440394	1.261223	1.934943	0.0592
C	-74.01472	64.07035	-1.155210	0.2540

R-squared	0.297556	Mean dependent var	5.315686
Adjusted R-squared	0.236474	S.D. dependent var	4.893971
S.E. of regression	4.276351	Akaike info criterion	5.836971
Sum squared resid	841.2102	Schwarz criterion	6.026366
Log likelihood	-143.8428	Hannan-Quinn criter.	5.909345
F-statistic	4.871408	Durbin-Watson stat	2.141991
Prob(F-statistic)	0.002326		

Source: E-view dataset

Again, when making correction to the model, none of the suggested independent variables were significant at 5% level of significance.

Time- Series

After analyzing the cross- sectional regression analysis, most of the results were insignificant for each state. Therefore, it is decided to run Time-Series regression in the United State as a whole, and then omitting each variable and run a regression on the rest in order to observe the changes and the impact of each action. In the time series model, the data is by listed by years from 1961 to 2007[vii]. These variables, their symbols, their definitions, the sources of data, and the functional form have been listed as follow:

- The Murder rate in the United States (MUR): is the dependent variable and the data are listed by year from 1961 to 2007[viii]. The murder rate is per (100,000).

- Population rate (POP): The data are listed by years from 1961 to 2007[ix]. The population for each year was in (10,000). It is converted to a natural log in order to standardize the units. Also, it is expected to have a positive relationship between population rate and murder rate.
- Income level per capita (PERIN): per capita income for each year is used in this analysis. Further, the natural log has been taken to standardize the units. Moreover, it is expected to have a negative association between income level and murder rate. The data are listed by years from 1961 to 2007[x].
- The unemployment rate for each year (UNEM): the rate of unemployed people is used in each year from 1961 to 2007[xi]. Hence, a positive correlation between unemployment and murder rate is expected.
- Capital punishment rate (CAP): The data are listed by year from 1961 to 2007[xii]. In essence, it is expected that the more capital punishments there were, the less likely people would commit murders. Thus, it's expected to have a negative association between capital punishments and murder rate.
- Year (Year): the range for this variable is from 1961 to 2007[xiii]. It is added to show how murder rate will change each year.

Below are the descriptive statistics of all the variables:

Table 5

	MUR	POP	PERINC	CAP	UNEM	YEAR
Mean	7.553191	19.27681	6.254681	1.354468	5.854255	1984.000
Median	7.900000	19.28000	6.130000	0.930000	5.620000	1984.000
Maximum	10.20000	19.52000	11.34000	5.050000	9.710000	2007.000
Minimum	4.600000	19.02000	-0.700000	0.000000	3.490000	1961.000
Std. Dev.	1.740796	0.147635	2.888999	1.437736	1.438353	13.71131

Skewness	-0.236794	0.041287	-0.085361	0.792437	0.682645	-2.82E-17
Kurtosis	1.606834	1.836817	2.517846	2.457838	3.338189	1.798913
Jarque-Bera	4.240178	2.662966	0.512336	5.494624	3.874344	2.825111
Probability	0.120021	0.264085	0.774012	0.064100	0.144111	0.243520
Sum	355.0000	906.0100	293.9700	63.66000	275.1500	93248.00
Sum Sq. Dev.	139.3970	1.002621	383.9304	95.08596	95.16755	8648.000
Observations	47	47	47	47	47	47

Source: E-views, data set

Given the aforementioned variables, the following functional form or the population model equation is suggested:

(+) (-) (+) (-) (+)

- **MUR= $\beta_0 + \beta_1 (POP)_t + \beta_2(PERIN)_t + \beta_3(UNEM)_t + \beta_4(CAP)_t + \beta_5 (year)_t + \varepsilon$**

Significance was determined using a one sided t-test with $\alpha = 5\%$. Also, the T critical was found to be 1.68. All values are rounded to the nearest hundreds. t-test statistics are listed in parentheses below their corresponding coefficients.

RESULTS

A regression including all variables was performed and the results were as follows**:**

[1] MUR = -320.82 – 88.16(POP) + .07(PERIN) + 0.27(UNEM) -1.09(CAP) + 1.02(year) +ε

t-stat (-6.82) (-4.55) (1.17) (2.71) (-4.36) (4.8)

Adjusted R^2 =0.76

Table 6

	Coefficients	Standard Error	t- Stat
Intercept	-320.8226905	47.0347192	-6.820975993
POP	-88.16452042	19.38910619	-4.547116279
PERIN	0.066712282	0.056934739	1.171732458
UNEMP	0.273250526	0.101011765	2.705135628
CAP	-1.093929995	0.163062306	-6.708662626
Year	1.02185049	0.208461488	4.901867015

Source: E-views, data set

Based on the results, 76 percent of the variation in murder rate is explained by our model. Also, when doing the t-test, population and the per capita income were insignificant. On the other hand, unemployment rate, capital punishment and the number of years were significant. They all had large enough t-stats and signs. As a result, if unemployment goes up by one percent, murder rate will increase by 0.27 percent holding other variables constant. If CAP goes up by one per 100,000, murder rate will decrease by 1.09 percent holding other variables constant. Years have a positive trend with population.

[2] MUR = -144.97 + 0.13(PERIN) + .38(UNEM) -0.93(CAP) + .07(year) +ε

t-stat (-4.47) (1.92) (3.17) (-4.83) (4.59)

Adjusted R^2 =0.64

Table 7

	Coefficients	Standard Error	t- Stat
Intercept	-144.9690538	32.43968611	-4.46887967
PERIN	0.128730712	0.06698513	1.921780432
UNEMP	0.377969829	0.119183208	3.171334572
CAP	-0.93242124	0.192855684	-4.834813365
Year	0.075991589	0.016563271	4.587957795

Source: E-views, data set

Eliminating POP had little impact on the coefficient and the adjusted R^2 decreased by 0.12. Further, our model explains 64 percent of the variation in murder. UNEM, CAP, and YEAR were found to be significant based on the t-test and signs, while PERIN was insignificant because it is different than our expected direction.

[3] MUR = -334.83 – 93.61(POP) + .0.24(UNEM) -1.20(CAP) + 1.08(year) + ε

t-stat ***(-7.33) (-4.95) (2.47) (-8.73) (5.33)***

Adjusted R^2 =0.7

Table 8

	Coefficients	Standard Error	t -Stat
Intercept	-334.8371847	45.69010767	-7.328439389
POP	-93.60696006	18.90793956	-4.95066952
UNEMP	0.241884147	0.097831625	2.472453527
CAP	-1.198228554	0.13722932	-8.731578313
Year	1.082167173	0.202900763	5.333480054

Source: E-views, data set

Eliminating PERIN had little impact on all the variables. Also, the adjusted R^2 did not change. t-test showed that all variables are significant except for POP.

[4] MUR = -363.75 – 100.12(POP) + .03(PERIN) -1.30(CAP) + .1.16(year) + ε

t-test ***(-7.66) (-4.94) (0.44) (-8.49) (5.36)***

Adjusted R^2 =0.50

Table 9

I	Coefficients	Standard Error	t Stat
Intercept	-363.7467809	47.49088918	-7.659296072
POP	-100.1227134	20.24861171	-4.944670518
PERIN	0.025896292	0.058883504	0.439788564
CAP	-1.304474409	0.15368804	-8.487806929
Year	1.160750361	0.216702378	5.356426506

Source: E-views, data set

Eliminating UNEM showed that the estimated coefficient for most of the variables increased except PERIN. The adjusted R^2 decreased by .24. Based on the t-test, CAP and YEAR were found to be significant, while POP and PERIN were found to be insignificant.

[5] MUR = -146.76 – 59.8(POP) + .0.28(PERIN) + .60(UNEM) + .66(year) + ε

t-stat ***(-2.61) (-2.21) (4.03) (4.70) (2.28)***

Adjusted R^2 =0.50

Table 10

Table J	Coefficients	Standard Error	t Stat
Intercept	-146.7565908	56.13915413	-2.614157501
POP	-59.83102385	27.07960846	-2.20944937
PERIN	0.275213961	0.068263892	4.031618359
UNEMP	0.59670191	0.127019333	4.697725102
Year	0.656468176	0.28794738	2.279819929

Source: E-views, data set

Eliminating CAP showed that the estimated coefficient for PERIN, and UNEM increased, while the estimated coefficient for POP and YEAR decreased. The adjusted R^2 decreased by .24. Based on t-test, UNEM and YEAR were found to be significant, whereas, POP and PERIN were found to be insignificant.

[6] MUR = -123.06 +6.67(POP) + .14(PERIN) + .40(UNEM) -0.89(CAP) +ε
t-stat (-4.09) (4.21) (1.98) (3.24) (-4.52)

Adjusted R^2 =0.63

Table 11

Table K.	Coefficients	Standard Error	t Stat
Intercept	-123.057657	30.08435197	-4.090420732
POP	6.673783071	1.581867969	4.218925474

PERIN	0.135628592	0.06865023	1.975646562
UNEMP	0.395211378	0.12181692	3.244306096
CAP	-0.885096171	0.195851686	-4.519216501

Source: E-views, data set

Interestingly, eliminating the YEAR showed that almost all of the variables were found to be significant except for PERIN. The adjusted R^2 decreased by .13. The estimated coefficient for CAP decreased, while POP, PERIN and UNEM increased. Omitting the year showed a large positive change on POP (bias was observed). Therefore, YEAR is a relevant variable in the model. However, deleting YEAR is justified by VIF, Variance Inflation Factor. Result for YEAR was 100, which is higher is than 10, plus that correlation between Year and POP is 0.99 which is higher than .75 which is considered to be a bench mark to indicate a high level of correlation and therefore an indication of **Multicollinearity**. Furthermore, before deleting YEAR, model [1] had wrong signs for the explanatory variables POP and PERINC. In other words, their signs after running the regression were different than what has been hypothesized, which is another indication of **Multicollinearity**.

Checking for Serial Correlation

However, when conducting the Durban Watson test to detect if the model is suffering from Serial Correlation, it was obvious that the model was experiencing Serial Correlation; the calculated Durban Watson was .47 which is less than the lower bound Durban Watson d_L, equal to 1.36, which indicates a positive serial correlation. Therefore, a correction for serial correlation is vital.

The below chart, chart L, shows the results after correcting for serial correlation and indicates, through the Durban Watson test that generated a calculated Durban Watson equal to

1.88, that serial correlation no longer exists. The only variable, after conducting the test, that is significant and therefore affecting the murder rate is income per capita.

Table 12

Dependent Variable: MUR

Method: Least Squares

Sample (adjusted): 1963 2007

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.55635	85.42062	0.673799	0.5045
LOGPOP	-2.552803	4.419366	-0.577640	0.5669
LOGPERINC	-0.039182	0.018003	-2.176426	0.0358
CAP	-0.056237	0.077108	-0.729330	0.4703
UNEM	-0.023639	0.075430	-0.313387	0.7557
AR(1)	1.558692	0.133855	11.64459	0.0000
AR(2)	-0.634873	0.129485	-4.903053	0.0000

R-squared	0.959947	Mean dependent var	7.680000
Adjusted R-squared	0.953623	S.D. dependent var	1.667688
S.E. of regression	0.359142	Akaike info criterion	0.931838
Sum squared resid	4.901356	Schwarz criterion	1.212874
Log likelihood	-13.96635	Hannan-Quinn criter.	1.036605
F-statistic	151.7908	Durbin-Watson stat	1.886208
Prob(F-statistic)	0.000000		

Inverted AR Roots	.78+.17i	.78-.17i

Included observations: 45 after adjustments

Therefore, the below model will be the final result after correcting for time series analysis:

[7] MUR = 57.55635 -2.55 (POP) -0.03 (PERIN) -0.02 (UNEM) -0.05 (CAP) +ε

t-stat (-0.31) (-2.17) (-0.31) (-0.73)

CONCLUSION

When doing the cross sectional analysis, none of the variables was significant even after omitting one variable each time and running regression. The only significant variable was unemployment. However, the significance of unemployment disappeared after making a Heteroscedasticity correction which means that none of the suggested independent variables had an effect on the murder rate. On the other hand, when performing a time series analysis and comparing its results with the cross sectional analysis, there was a surprising result.

Most of variables were relatively significant to what have been found when performing the time series analysis. Furthermore, in the time series analysis, population, unemployment and capital punishment were significant when the YEAR variable was excluded. However, our model was suffering from serial correlation, when performing the Durban Watson test, and when correcting for that problem, none of the suggested independent variables in model number 6 were having a significant effect on the murder rate except for income per capita.

Overall, I observe that Model [7] in the time series regression, with the YEAR variable left out, is the most correct analysis yielding significance for only income level per capita.

The table below, Table M, summarizes the results from both models of regressions, cross sectional and time-series, after correcting them from Heteroscedasticity and Serial Correlation, it has been formed in order to observe the differences between the two models.

Table 13

	Cross Sectional		Time series	
	Coefficient	t-stat	Coefficient	t-stat

POP	-0.50	-0.49	-2.55	-0.31
PERIN	6.47	1.02	-0.03	-2.17
UNEMP	2.44	1.93	-0.02	-0.31
EDU	0.17	0.72	-	-
CAP	-	-	-0.05	-0.73
YEAR	-	-	-	-

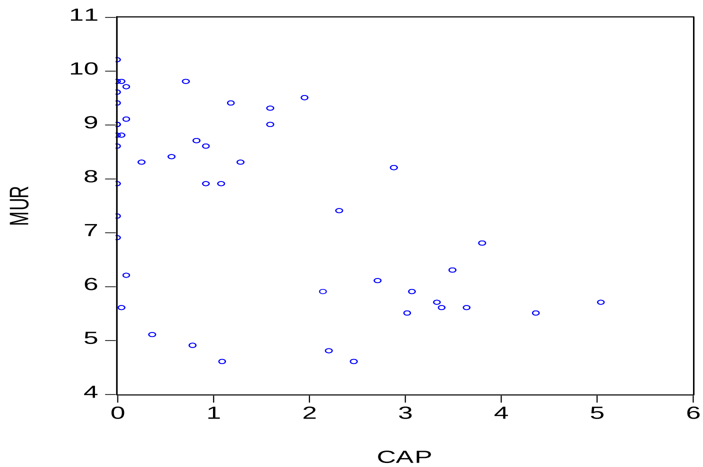

Figure 1 In Time- Series Model The Curve Between Capital Punishment Rate And Murder Rate Is Nonlinear.

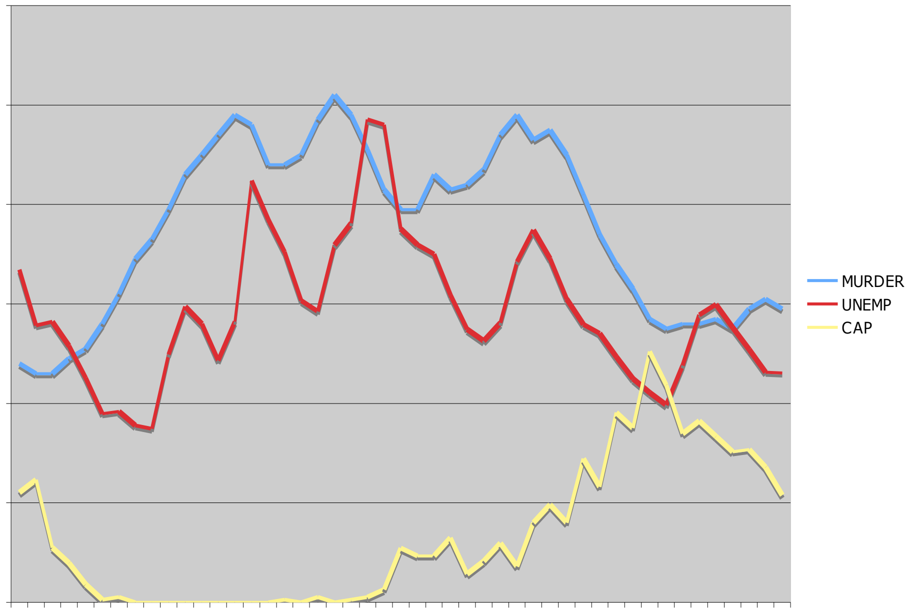

Figure 2 Cross-Sectional Model shows positive slope between Capital Punishment Rate and Murder Rate.

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